

## **Exhibit K**

**Expert Report of Daniel Henry, M.D.**

In re W.R. Grace & Co., *et al.*

October 3, 2006

**Observations on the Application of Conventional Chest Radiography in Asbestos Litigation**

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##### **I. Authorship**

My name is Daniel A. Henry, M.D., F.A.C.R., and I am a Chest Radiologist and Section Chief of Thoracic Imaging in the Department of Radiology at the Medical College of Virginia School of Medicine at Virginia Commonwealth University. I obtained my medical degree from

the St. Louis University School of Medicine. I served an internship at the St. Louis University Group Hospitals, and a radiology residency at the Medical College of Virginia. Upon completion of my residency, I served two years in the U.S. Air Force, attaining the rank of Major, and returned to the Medical College of Virginia as a faculty member in 1977. My academic career has been solely confined to the teaching of and practice of imaging of the chest for the past 30 years. In 1985, I was certified by the National Institute of Occupational Safety & Health ("NIOSH") as a B-reader and have been continuously recertified as a B-reader for the last 21 years. Since 1990, I have been a Member of the American College of Radiology ("ACR") Committee (Task Force) on Pneumoconioses, and I have been the Chairman of the ACR Pneumoconioses Committee since 2005. For many years, the ACR Pneumoconioses Committee in collaboration with NIOSH, has periodically taught an educational course for physicians who wish to be certified or recertified as a B-reader. As a member of the ACR Pneumoconioses Committee faculty for that course, I teach a segment of the B-reader course dedicated to asbestos-related disorders.

I am a cofounder and member of the Virginia Commonwealth University Occupational Pulmonary Committee. In this capacity I interpret chest X-rays for the Workers Compensation Committee of the Commonwealth of Virginia. Since 1995, I have been an on-going participant in the NIOSH coal miners health surveillance programs and continue to act as consultant for their pneumoconioses chest radiography instruction programs. I am also a member of the Radiological Society of North America, American Roentgen Ray Society, Society of Thoracic Radiology, and a member and Fellow of the American College of Radiology.

## **II. Introduction**

On April 26, 2005, Dr. James Crapo appeared before the Senate Judiciary Committee to read a prepared statement regarding the medical criteria for S. 852, The Fairness in Asbestos

Injury Resolution Act of 2005. Dr Crapo is a Professor of Medicine and Pulmonary Diseases at the National Jewish Medical and Research Center in Denver that is the nation's top ranked hospital in pulmonary disease. He is also past president of the American Thoracic Society. S.852 or the "Fair Act of 2005" proposed the development of a national trust to address the myriads of claims for asbestos related disorders. Dr. Crapo wrote in his introductory comments:

"Occupational exposure to significant levels of inhaled asbestos causes a number of diseases including: mesothelioma; lung cancer; and non-malignant lung conditions, asbestosis and pleural reactions. The challenge in writing medical criteria for a national trust is that the above conditions are not always related to asbestos exposure and some do not involve functional impairment. Individuals may develop similar diseases but without contributory causation from asbestos exposure. Distinguishing non-asbestos related cases from those caused by asbestos exposure, based on scientific and medical standards, is an important element in setting up a valid trust. One of the primary challenges for this trust is to ensure that those individuals with a significant injury and impairment for exposure receive an appropriate compensation while minimizing inappropriate compensation of individuals who have no impairment due to asbestos exposure including those whose disease or injury is similar to, but not caused by asbestos. If large amounts of trust funds are distributed to individuals who do not have an asbestos related injury it puts the entire trust at risk and could lead to those with asbestos related injury not being compensated."<sup>(1)</sup>

Additional comments of interest included the recommendation of a rigorous quality assurance program to ensure the reliability of the medical data including an independent B reading of the chest x-rays for all claims. He proposed a comprehensive audit procedure to

review all claims to strengthen the function of the proposed trust. S.852 the "FAIR Act of 2005" remains in limbo, however, the cogent comments of Dr. Crapo are very striking and appropriate.

Similar to the process of developing a national trust for asbestos claims and the concerns raised by Dr. Crapo, W.R. Grace faces a like challenge of funding a trust and establishing valid scientific and medical standards for the review of asbestos claims so that individuals with significant injury and impairment from exposure receive appropriate compensation while compensation of invalid claims is minimized.

In this report, I will discuss a reliable method for evaluating chest x-rays and will discuss the methods currently employed. I will also comment on imaging related suggestions of the American Thoracic Society (ATS)'s recent statement for diagnosing and treating non-malignant asbestos-related disease. Finally, I will propose a protocol for acquiring and evaluating credible chest x-ray data for the individuals who have sued W.R. Grace.

### **III. The Chest X-Ray and the ILO System of X-Ray Classification as an Evaluation Tool**

#### **A. Background**

##### **1. The Chest X-Ray or Chest Radiograph**

Traditionally, asbestos diagnoses are based upon exposure history, latency, physical impairment usually indicated by abnormal pulmonary function studies, and a chest x-ray ("CXR") demonstrating evidence of asbestos related disease. The CXR is a reliable, available, reproducible, inexpensive and noninvasive tool that is readily accepted by the public. CXRs performed periodically form a useful basis for investigating temporal and geographic trends in pneumoconiosis occurrence and can also be used to identify sites where workers appear at increased risk for dust exposure and lung disease <sup>(2)</sup>. The CXR remains the primary means of determining the presence and extent of one important type of lung disease resulting from dust exposure – pneumoconiosis – including, of course, the radiographic abnormalities caused by

asbestos exposure<sup>(3,4)</sup>. The ATS in its most recent statement on the diagnosis of non-malignant diseases related to asbestos describes the chest radiograph as “an extremely useful tool for the radiographic diagnosis of asbestosis and asbestos-related pleural disease and is widely available internationally. The plain film has long been the basis for assessing asbestos-related disease of the lung and pleura”<sup>(5)</sup>.

## 2. The ILO system

The use of the CXR has been facilitated by the application of the International Labor Organization's (ILO) classification system, most recently, the *International Classification of Radiographs of Pneumoconiosis, 2000*<sup>(6)</sup>. The classification process entails the paper tabulation of the following: the presence of parenchymal (lung) opacities and their profusion or concentration based upon a 12 point scale ranging from “cold” normal to advanced disease; the detection and scoring of both large parenchymal opacities and pleural abnormalities; and other diseases or findings represented by symbols or written notation. The system also includes a notation for contacting the worker or referral back to his or her physician for unexpected or urgent findings. Over the last seven decades the ILO has produced a series of guidelines on how to classify CXRs of persons with pneumoconioses. The current *Classification* is a revision of earlier editions (1950, 1958, 1968, 1971, and 1980). The latest edition contains changes based upon a comprehensive review of experience in using the preceding edition. The *Classification* is used internationally for epidemiological research, for screening and surveillance for those in dusty occupations, and for clinical purposes<sup>(6)</sup>. The ILO classification system is the basis of the NIOSH B-reader program (see below) and the certification of individuals as knowledgeable in classifying pneumoconioses CXRs.

### 3. B-Readers

The National Institute of Occupational Safety and Health (NIOSH) sponsors a program to certify individual physicians who exhibit proficiency in interpreting CXRs of individuals with pneumoconioses. These physicians, examined and certified by NIOSH using the ILO system, are classified as "B- readers." The B reader examination was originally developed to identify physicians qualified to serve in national pneumoconiosis programs directed at coal miners and others who suffer from dust related diseases. This originally included epidemiologic research on coal workers' pneumoconiosis and the compensation of coal miners with pneumoconiosis under programs processed by government agencies. The original intent of the B reader program still exists, but B readers are also now involved with the epidemiologic evaluation and surveillance programs involving many types of pneumoconioses, including asbestos. By evaluating the ability of a reader to classify a test set of radiographs (chest x-rays) and certifying only those who achieve a certain level of proficiency, the B reader program is intended to ensure that physicians who read chest radiographs for evidence of pneumoconiosis using the ILO Classification system are as accurate and precise as possible <sup>(7)</sup>. For the period 1987-1990, the last interval for which published data is available, about 47% of physician candidates taking the certification examination passed. This includes a high of 57% in 1987 to 35% in 1990. Approximately 67% pass the recertifying examination. There is a consistent tendency on both the certification and recertification examinations toward over-reading as the mean percent of false positive (PFP) readings hovers around 20%. The PFP is the percent of time the candidate classified a chest x-ray as positive (1/0 or higher) when an expert panel classified the chest X-ray as negative (0/1 or less) <sup>(8)</sup>. As would be expected, radiologists, with extensive training and experience in film interpretation, are generally more successful on the examinations than non-radiologists. There are currently 531 B-readers listed on the NIOSH B-reader website down from > 700 over the last

decade. The number of B-readers actively engaged in film classification is far, far less than the listed number. B-readers are commonly viewed as more expert in the interpretation of CXRs presenting findings of dust related diseases, the pneumoconioses.

The American College of Radiology ("ACR") offers an instructional course that complements the B-reading examination. Many of the physicians who are preparing to take the B-reading examination for the first time or are re-certifying take this course. The course lasts two days and covers the radiology and pathology of coal, silica, and asbestos pneumoconiosis. As a member of the ACR Committee on Pneumoconioses, I teach a segment of the course covering asbestos-related disorders. I assumed the Chairmanship of the ACR Pneumoconiosis Committee in 2005.

**B. The ILO Classification System: Standard Radiographs**

More recent versions of the ILO *Classification* are composed of written instructions and explanations and are accompanied by a set of ILO standard radiographs (CXRs). The system is designed for the classification of pneumoconioses including coal workers pneumoconiosis (CWP), silicosis, as well as asbestos related disorders. The ILO standard radiographs are CXRs that depict the radiographic findings of the dust diseases that produce the small rounded and large opacities on the CXR that are associated with silicosis and CWP. Other standard radiographs present irregular or linear opacities and pleural plaques and thickening that characterize asbestos related disorders. The standards are thus basically divided into two groups, those portraying rounded opacities and those portraying irregular opacities. There are also two normal radiographs or CXRs in the group.

The ILO standard films displaying small lung opacities are essential to the interpretation and classification of CXRs in individuals with pneumoconiosis such as asbestos exposure. Each

worker CXR must be compared to the appropriate ILO standards to most accurately determine the proper classification. This comparison is a critical step of the classification process.

**C. Identifying Small Opacities and the ILO Standards**

**1. Size and Shape of Small Opacities**

Each standard film presents a specific size of either rounded or irregular opacities and a specific profusion or concentration of opacities within the lungs. Other standards display characteristic features of the pneumoconioses such as pleural plaques or large opacities. Small rounded opacities which characterize exposure to coal and silica range in size from up to 1.5mm or "p" sized opacities, to 1.5-3mm or "q" opacities, and to 3-10mm or "r" opacities. Small irregular opacities seen with asbestosis range in size from up to 1.5 or "s" opacities, to 1.5-3mm or "t" opacities, and to 3-10mm or "u" opacities. As part of the classification process, the B-reader must determine the shape and size of the small opacities present. If the shape and size of the opacities are a mix of "s" and "t" opacities with more of the former than the latter, the designation for shape and size would be s/t. If the opacities were all most similar to the "t" opacity, the designation would be t/t.

**2. Opacity Profusion, Categories and Subcategories**

An individual ILO standard CXR depicts a chest with each size and shape opacity. Thus there is a standard CXR presenting small irregular "s" opacities, while another presents "t" sized opacities, etc.

There are actually 3 standards for each opacity in increasing levels of profusion or concentration. For example, there is a low profusion "t" standard identified as category 1; a second standard with intermediate profusion or concentration of "t" opacities designated as category 2; and finally a third standard with the highest concentration of "t" opacities designated as category 3.

The standard radiographs, categories 0, 1, 2, and 3, define four major categories.

Category 0 refers to the absence of small opacities or the presence of small opacities that are less profuse than the category 1 standard for a particular opacity. Category 2 presents a greater profusion of small opacities than category 1, etc. Given the variability in the appearance of CXRs of dust-exposed workers and to be able to more accurately describe their appearance, a 12-subcategory system is used for classification. For example, going back to the "t" opacity, if a worker CXR presented "t" opacities that were very similar in profusion or concentration to the category 1 "t" standard, the CXR would be classified as category 1/1. The category 1/1 indicates that the CXR was most similar to the category 1 "t" standard and that neither the category 0 standard nor the category 2 "t" standard were similar enough to the worker CXR to be seriously considered as alternatives. However, if the CXR most resembled the category 1 "t" standard but the category 2 "t" standard was seriously considered as an alternative, the category would then become 1/2. If the CXR strongly resembled the category 2 "t" standard but the category 1 "t" standard was also seriously considered as an alternative, the category would be designated 2/1. Thus for each major category, 0 through 3, there are 3 minor categories: 0/-, 0/0, 0/1; 1/0, 1/1, 1/2; 2/1, 2/2, 2/3; 3/2, 3/3, and 3/+. The standard ILO radiographs present the mid-profusion or concentration of each major category, i.e., 0/0 and 1/1, 2/2, and 3/3 for each opacity. The normal standards, referring to the absence of small opacities or fewer opacities than the 1/1 standard for each opacity, are designated as 0/0.

#### **D. Identifying Pleural Abnormalities Using the ILO System and Standards**

Pleural abnormalities, both localized pleural plaques and diffuse pleural thickening are also depicted on the ILO standard radiographs but their classification is more dependent on the ILO written guidelines rather than a specific standard radiograph. Plaques are classified as either present or absent and if present, in-profile or face-on, calcified or not calcified, and separately

classified as to left and right. The locations of the plaque or plaques are recorded and include the chest walls, the diaphragms, and other sites. The extent of chest wall plaques is recorded as it relates to the lateral chest wall length:  $<1/4$ ;  $>1/4$  to  $= 1/2$ ;  $> 1/2$ . If diffuse pleural thickening is present, suggested by the obliteration of the angle between the diaphragm and inferior chest wall, the same determinations must be made as for localized pleural plaques, left and right, calcification, etc. All of these various designations are recorded on the B-reader form. In addition, the form presents a series of "short hand" symbols to record the presence of other significant abnormalities such as "co" to designate an enlarged heart and "fr" to indicate a rib fracture, and several others. <sup>(6)</sup>

#### **E. Assessing Film Quality is a Critical Component of the ILO Classification System**

Another very important step of the B-reader classification process required by the ILO guidelines is the determination of the technical quality of the radiograph or CXR. In other words, how well is the anatomy of the chest depicted, especially the fine detail of the lungs. It has long been recognized that the technique and equipment used for chest radiographic imaging of dust-exposed workers affect the radiographic appearance of small opacities and pleural abnormalities, and thus can influence the classification of a radiograph (CXR) for pneumoconiosis <sup>(6)</sup>. Classification for any application requires good-quality radiographs and consequently readers may find it difficult to use the ILO Classification system if the quality of the chest radiograph is sub optimal. In some instances, it may be impossible to classify such a radiograph.

##### **1. Grades of Technical Quality**

The ILO Classification specifies four grades of technical quality to be used: 1, Good; 2, Acceptable, with no technical defect likely to impair classification of the radiograph for

pneumoconiosis; 3, Acceptable, with some technical defect but still adequate for classification purposes; 4, Unacceptable for classification purposes (U/R). If technical quality is not grade 1, the B-reader must comment about the technical defect. Common quality faults include underexposure (often associated with a tendency to read more profusion than would be recognized on an optimally produced radiograph) and overexposure (associated with the converse tendency) <sup>(6)</sup>. CXRs designated film quality 1 or 2 are usually readily classified in most instances. CXRs designated film quality 3 are a somewhat different situation. These images have a "technical defect". This defect commonly reflects a problem with the exposure of the CXR. An example would be an underexposed film that would be associated with an over-reading tendency by most B-readers. In this instance, the B-reader must adjust his or her assessment to compensate for the technical defect so that the film is not over-read and the proper profusion of small opacities determined. This of course introduces subjectivity into the classification process as the B-reader recognition of the problem and subsequent adjustment will vary. It is important to recognize that the ILO guidelines contain a footnote regarding quality 3 CXRs (films) suggesting that they should be replaced by a better quality study and if it cannot be replaced, "more details about technical defects should be recorded" <sup>(6)</sup>.

## **2. Common Film Quality Faults**

In addition to over- and underexposure, there are more insidious problems with film quality that can affect classification. Film contrast, which is related to exposure, can be an issue. While technically acceptable, CXRs that are more "black and white" will emphasize the denser structures such as the ribs. Grayer films de-emphasize the denser structures and generally enhance detail. Variations in film contrast can be a factor in over- and under reading small opacities.

Film mottle is another common fault that can be a very serious problem. This is a delicate “salt and pepper” pattern most visible in the soft tissues of the chest musculature or the neck. This pattern is not confined to the soft tissues but is subtly extended across the entire CXR, including the lungs. This speckled pattern can simulate small opacities and can modify the appearance of normal structures to make them less distinct and appear abnormal. Film mottle generally results from an exposure that essentially doesn’t have enough energy. It can also be caused by mismatched or inadequate equipment. It can also occur if the worker is large or obese and the film exposure technique is inadequate.

Film quality in larger patients is always a challenge. Many workers who perform physical labor are large people. Our population is not getting leaner and generous soft tissue puts more demand on the radiographic exposure systems for good quality radiographs. Depth of inspiration is another problem, more common with larger or obese patients, reducing the lung detail and complicating interpretation. Many obese patients simply cannot take a deep breath. Films with too much contrast, over-exposure or under-exposure, excessive mottle, or exposed at a shallow depth of inspiration force readers to adjust their thresholds for abnormality.

Overall film quality has plagued the classification process for decades and is a factor in reader variability <sup>(9, 2, 10, 11)</sup>. Although there are very detailed recommendations available on various aspects of film quality for the classification system <sup>(6, 12, 13)</sup>, poor film quality remains a constant. At present, the act of meeting film quality standards is largely voluntary and not strictly enforced. As a radiologist for over 35 years, I have years of experience in monitoring and improving film quality especially for CXRs. I deal with stationary equipment in large institutions with the support of experienced qualified radiologic technologists, physicists, radiology maintenance personnel, and vendor support. Film quality remains a challenge even as the

technology advances. Maintaining film quality in any portable environment, such as a van or truck mounted equipment, would be a major challenge. Even smaller stationary facilities, such as private offices or non-health care facilities such as factories, struggle with film quality. Budgets would be accordingly smaller with cheaper, less capable equipment, operated by individuals with limited training and experience and without the personnel I described above.

Thus film quality is a constant variable requiring rigorous exposure techniques and attention to detail in both the film acquisition and interpretive processes. Film quality can also be a subtle niche in which abuse can occur either by ignorance or design. It presents a dual problem. First, poor film quality can subtly produce "abnormality" where none exists. Secondly it gives the B-reader license to "adjust" his or her assessments to compensate for the technical defects. Films of technical grade 1 or 2 avoid these adjustments and should be of sufficient quality to minimize over- or under-interpretation.

#### **F. Validation of the Chest X-Ray and the ILO System**

##### **1. Pathologic and Physiologic Correlation**

Autopsy studies have validated the ILO classification system correlating profusion of small opacities with autopsy findings, suggesting that CXRs are useful indices of dust content of the lung <sup>(2, 14, 15, 16)</sup>. The same is true for silica and asbestos, except that the correlation between level of exposure and radiographic response is less linear due to the lung's tissue response to the dusts <sup>(16, 17)</sup>. Pulmonary function impairment in asbestos disease does show correlation with increasing profusion or concentration of small opacities in major categories, although variation in minor categories showed no correlation <sup>(2, 18, 19, 20)</sup>. Thus, the ILO classification system is internationally recognized and widely and routinely employed in the evaluation of persons exposed to occupational dust diseases including asbestos related disorders. The system has even

been applied to the evaluation of other pulmonary diseases unrelated to occupational dust exposures <sup>(11, 23, 24, 25, 26)</sup>.

## **2. Role in Compensation**

The object of the ILO classification is to “codify the radiographic abnormalities of the pneumoconioses in a simple, reproducible manner, the classification neither defines pathologic entities nor takes into account working capacity. It does not imply legal definitions of pneumoconioses for compensation purposes and does not imply or set a level at which compensation is payable” <sup>(6)</sup>. However, over the years, radiographic classification systems for the pneumoconioses have been associated not only with disease detection and exposure monitoring but also with worker compensation as well. In 1936, the U.S. Secretary of Labor sponsored the “National Silicosis Conference” at which many topics were discussed including the compensation of disabled workers. The 1969 Federal Coal Mine Health and Safety Act, a sentinel event in the development of the B-reader system, specifically mentions the ILO system and contains provisions for compensation. Indeed the very roots of classification systems in the US as early as 1917 and in Great Britain, Europe, South Africa, and Australia in the 1920s and 1930s focused on better understanding dust diseases, their origins, prevention, and disability compensation <sup>(27, 28, 29, 2)</sup>. The proposed “FAIR Act of 2005” contains provisions for B-readings. The ILO system and b-reading of CXRs is entrenched in federal regulations, worker compensation programs and asbestos litigation.

## **IV. Current Practices of Recruiting and Radiographically Evaluating Potential Asbestos Claimants**

### **A. Background of Screening Companies**

A study by the RAND Institute for Civil Justice in 2005 stated that 730,000 asbestos plaintiff claims have been filed in the last 30 years, with more than 500,00 cases filed since 1990

(30, 31). The RAND study estimated that more than 90% of all pending asbestos claims are screened nonmalignant plaintiffs derived from individuals without symptoms and possibly based on unreliable medical data. Screening companies, either independently or at the behest of plaintiffs law firms or other sponsors, solicit clients through advertising that sometimes includes financial or even "lottery" type incentives. They frequently use portable x-ray equipment loaded onto a variety of vehicles and appear at locations convenient to a concentrated number of clients. These programs, a catalyst for skyrocketing numbers of claims, rely heavily on the CXRs to identify those with possible claims.

The screening companies seek out physicians with the B-reader designation to interpret their clients' CXRs. Recognition of the characteristic radiographic features of asbestos related disorders coupled with their distinction from other processes that could simulate asbestos disorders is the initial step in the radiographic interpretation process. The pneumoconioses are not routinely seen. As protective measures found their way into the workplace decades ago, the common or characteristic radiographic features of these diseases are encountered less frequently. Due to the geographic concentrations of industries where these dusts were common, some medical or radiographic practices would rarely or perhaps never encounter a case.

Once the CXR is interpreted by a B-reader as positive for an asbestos related disorder, the radiology or imaging leg of the process is satisfied and the claim proceeds. No matter how many clients were screened, if the CXRs were interpreted as negative, the claims had little merit. Given the avalanche of asbestos claims over the past decade, there is the strong suggestion of collusion between screener and B-reader, B-reader misinterpretation, or the nation was experiencing an epidemiological phenomenon.

**B. Questions Regarding the Appropriateness and Inconsistencies of B-Reader Interpretations**

Various courts, defendants, and others have raised concerns about the screening process and the bulge in claims. I personally had an experience with the "N&M Inc." screening company in 1999. I was contacted by Heath Mason, an individual previously unknown to me, and queried as to my interest in "doing 300+ b-reads". Mr. Mason's company was based in Mississippi. I raised questions about the legality of my participation since I was not licensed in Mississippi. He told me a local physician had already read the CXRs for clinical purposes and all that was needed was a b-read. He sent me 300+ films (CXRs) for interpretation. I scored the vast majority of the films as film quality 3 indicating significant technical defects but still readable. Nearly all the CXRs I reviewed showed significant mottle, which is a technical defect. The mottle could have easily contributed to an interpretation of minimal or mild disease. Accordingly, I had to adjust my interpretation. As I recall, most of the CXRs were negative but the film quality was marginal and most of the individuals were large. Thus, interpreting these CXRs accurately was a challenge due to the film quality. When I returned the films and B-reader forms with my readings, the gentleman called me, irate that I had downgraded the films for marginal quality. It was my understanding that my interpretations negatively impacted the reimbursement for each claim.

Regardless of my and similar experiences and suspicions of a variety of interested parties, it wasn't until a paper appeared in the scientific literature in 2004 that a considerable amount of attention was drawn to the problem. The study which appeared in a peer reviewed national radiology journal compared the readings of physicians retained by attorneys representing persons alleging respiratory disease from occupational exposure to asbestos and the readings of neutral independent physicians. Initial readers interpreted study CXRs as positive for lung abnormalities (ILO small opacities profusion category of 1/0 or higher, see below) in 95.9% of 492 cases. Six

neutral physicians readers classified the same CXRs as 1/0 or higher in 4.5% <sup>(34)</sup>. The news media recycled the story with several newspaper articles including the Wall Street Journal and the story appeared on the NPR website. Other stories of a similar variety began to surface including a report in a radiology trade magazine which detailed the experience of a B-reader at a large international professional meeting who was approached by an individual promising a substantial fee for the B-reader's signature on blank b-reader forms for CXRs read overseas by a third party or parties.

This journal article and other reports <sup>(17, 34-38)</sup> appear to have opened the door to a stunning awareness of the potential for fraud in asbestos claims and the domino effect for screening programs and physicians employed by plaintiff attorneys. It also cast a long shadow over the avalanche of asbestos claims over the last decade. The entire process including the NIOSH B-reader program was shaken to its roots. For this decades old system, NIOSH developed web sites outlining the appropriate applications of the B-reader process and the ILO system in various clinical and epidemiological situations <sup>(39)</sup> as well as a separate web page underscoring their ethical application <sup>(40)</sup>.

## **V. American Thoracic Society 2004 Statement**

### **A. Background: 1986 ATS Statement**

In 1986, the ATS reviewed the medical literature and presented an authoritative consensus view of the current state of knowledge regarding the diagnosis of non-malignant disease related to asbestos <sup>(41)</sup>. This document stressed the importance of the careful consideration of all relevant clinical findings. These findings included a reliable history of exposure, an appropriate latency period, CXR findings, pulmonary function test abnormalities indicating restrictive impairment and decreased diffusion capacity, and specific findings on physical exam. It stressed the findings on the CXR as the most important and established a

threshold for positivity of small irregular opacities with a profusion of 1/1 according to the ILO system. This document also stressed the point that when the threshold of small irregular opacities on CXR was not met, considerable caution was urged regarding the diagnosis of interstitial fibrosis due to asbestos exposure. It further stated that it was possible asbestosis may be present even though the clinical criteria including the CXR were not satisfied. In those circumstances, the clinical diagnosis could not be made <sup>(41)</sup>. These criteria were employed for nearly 20 years.

**B. 2004 ATS Statement**

In 2001, the ATS convened a group to update the 1986 criteria. The literature was again reviewed and a document developed that was completed and published in 2004 <sup>(5)</sup>. This statement, developed by 11 members of the Society, discusses diagnostic criteria, clinical evaluation, non-malignant disease outcomes, and implications of diagnosis for patient management. The diagnostic criteria formulated in this statement are slightly modified from those presented in 1986:

- Evidence of structural pathology consistent with asbestos-related disease as documented by imaging or histology
- Evidence of causation by asbestos as documented by the occupational and environmental history, markers of exposure (usually pleural plaques), recovery of asbestos bodies, or other means
- Exclusion of alternative plausible causes for the findings <sup>(5)</sup>

**C. Concerns Regarding the 2004 ATS Statement**

I was surprised and puzzled by a few of the Statement's comments related to chest imaging. I was not alone in my concern as several letters to the editor were critical of some of the same comments regarding chest imaging that caught my attention. The letters' authors were all from academic institutions and voiced a variety of concerns regarding: a) the statement's failure to address the crisis in asbestos litigation <sup>(42)</sup>; b) the failure to fully consider alternative points of

view and all of the available literature in several important areas<sup>(43)</sup>; c) statements that are not supported by the literature<sup>(44)</sup>; d) the Society's lack of recognition on the confounding effect of cigarette smoking on the diagnosis of asbestosis<sup>(45)</sup>; e) and the absence of a conflict of interest statement from the statements' authors<sup>(42)</sup>. One of the critics accused the statements authors of bias and a pro-plaintiff posture. He has developed several web sites extensively critiquing the document and underscoring its perceived bias<sup>(46, 47)</sup>

The Society responded to these letters of criticism and concern by stating that "the Statement was never intended to be a comprehensive review of the literature on asbestos, a task that would require years and multiple volumes." This response is disappointing given that the 2004 ATS Statement purported to be a comprehensive and definitive resource for the diagnosis of non-malignant asbestos-related disorders. The response goes on to say that the Statement is an update and "where a dispute, controversy, or uncertainty affect clinical management, it is discussed; otherwise, we cite the reference that was most relevant"<sup>(48, 49)</sup>. The Statement does cite two references regarding screening programs but the comments are primarily directed at the need for physician supervision and the notification and counseling of workers. The response never addresses the issues of screening programs and asbestos litigation nor the potential legal impact of the updated diagnostic criteria presented in the Statement. There was an additional opportunity for the Society to address the asbestos litigation issues in a response to a letter citing "questions" about the role of B-readers and referencing two articles discussing the asbestos litigation controversies. The Society's puzzling response chided the letter's author for his error in relegating ownership of the B-reader program to the ILO rather than NIOSH rather than addressing the issue. Conflict of interest statements were subsequently published with the Society's response<sup>(48, 49)</sup>.

Others can debate the bias or lack of bias in the 2004 ATS document although it is interesting that the tardy conflict of interest statements do indicate that many contributors were active in asbestos litigation for plaintiffs or plaintiffs' attorneys. However, I am most troubled by 2 areas regarding imaging and chest radiography that concerned others who responded with correspondence to the ATS.

### **1. Smoking and Small Opacities**

The first area of concern deals with the effects of smoking and the presence of small opacities on CXRs. The ATS Statement reaches the conclusion "...smoking alone therefore does not result in a chest film with the characteristics of asbestosis." A reference is cited in the Statement that discusses the role of smoking in the development of small lung opacities and pleural abnormalities in urban and rural Finnish populations both exposed and unexposed to asbestos <sup>(50)</sup>. Asbestos exposure was determined by questionnaire and interview. The following quote is from the "Discussion" section of this reference:

"A clear association was observed between smoking and small lung opacities, even after adjustment for occupational exposure to asbestos, age and urbanization. More interestingly, the effect of smoking was evident among those with unlikely occupational exposure to asbestos. This latter finding ...may cause a radiographic pattern of small irregular opacities distinguishable from interstitial pulmonary fibrosis only with high resolution computed tomography (HRCT)....Our results support the view that smoking may interfere with radiographic detection of early pneumoconiosis either by being capable of causing at least mild pulmonary fibrosis even in the absence of asbestos exposure or by being related to emphysematous and post inflammatory changes indistinguishable from interstitial fibrosis in chest radiographs. The small opacities in smokers with an unlikely asbestos exposure did not differ in size and shape from the opacities in never-smokers exposed to asbestos." <sup>(50)</sup> This reference does not support the ATS position.

Another reference relevant to this topic cited by the ATS Statement concludes that "Cigarette smoke has not, however, consistently been shown independent of asbestos to be an important contributor to roentgenographic small opacities"<sup>(51)</sup>. This comment seems to contradict the earlier reference. Neither of these contradictory references supports the finality of the ATS Statement comment regarding the contribution from smoking and small opacities.

Indeed, there are numerous references that do not support the Statement and add caution to the interpretation of small opacities in smokers especially in the situation of limited asbestos exposure and in low profusions on CXR<sup>(52-57)</sup>. In 1997, a scientific paper was published that reviewed eight published articles presenting data on nine study populations relevant to the prevalence of small lung opacities in unexposed populations. This literature analysis concluded that "a background level of opacities consistent with the radiographic appearance of pneumoconiosis exists in populations considered to be free of occupational dust exposure"<sup>(58)</sup>. The authors further suggested an average prevalence of small opacities at 5.3% in existing studies but noted that the prevalence could vary in differing unexposed populations. It is interesting to note that in the reference cited above<sup>(59)</sup> from the ATS Statement, in a population of 661 heavily exposed asbestos workers, only 10% had small opacities on CXR.

The confidence in radiographically excluding or minimizing the effects of smoking and the presence of small opacities on CXR in the ATS Statement seems to be predicated on the strong assumption of significant asbestos exposure from history. The ATS response to criticism regarding its comments negating the effects of smoking states that given "the criteria require evidence for nontrivial exposure to asbestos, the limited effect of even heavy cigarette smoking on the profusion of small opacities (at most one minor category), and the criterion requiring exclusion of alternative diagnosis, misdiagnosis is unlikely in practice"<sup>(48, 49)</sup>. Basically the

exclusion of smoking as an agent can be minimized when there is a history of heavy or "nontrivial" asbestos exposure. It would seem that a great deal of emphasis has been placed on the documented occupational history rather than the "Evidence of structural pathology consistent with asbestos related disease as documented by imaging or histology" <sup>(5)</sup>. Furthermore, this historical assumption of non-trivial exposure could create a greater tendency in the reader to find the CXR positive for an asbestos-disease. It doesn't seem appropriate to dismiss or minimize the confounding impact of smoking on the presence of small radiographic opacities. Furthermore, several studies have shown that smoking increases opacities in asbestos exposed workers and one reference speculated that the effect of asbestos exposure and smoking appeared additive <sup>(21)</sup>. A large study of civilian and military employees with current or historical exposure to asbestos had a higher prevalence of definite radiologic lung abnormalities (ILO 1/0) among smokers as compared to non-smokers, a pattern that existed among all age groups and increased with age <sup>(60)</sup>.

In addition, the radiographic opacities seen with asbestosis are not unique to that disease. Similar opacities can be seen in a number of other entities including idiopathic interstitial fibrosis, sarcoidosis, congestive heart failure, scleroderma, rheumatoid arthritis, and others. Even in patients with a history of asbestos exposure, when it is presumed that a diffuse interstitial lung process reflects asbestosis, other non-asbestos related interstitial diseases have been pathologically documented <sup>(61, 62)</sup>.

In 2002 the ATS in concert with the European Respiratory Society published a consensus document on the classification of interstitial pneumonias <sup>(63)</sup>. This document discusses a group of lung diseases that are very likely part of a spectrum of reactions to smoking. These entities present a variable pattern of interstitial fibrosis and inflammation. They can produce small opacities on CXR. The contribution these entities make to the overall smoking population and

their CXRs is not known since no large series of patients with these entities addressing this specific question has been published. However, it is peculiar for one set of ATS guidelines to ignore a previous Society consensus statement on a related topic and rely on references published before the relationship between smoking and these other entities was clarified.

## **2. Radiographic Threshold for Abnormality**

### **a. '86 vs. '04 Asbestosis Threshold on Chest X-Ray**

My second major concern regards the change in CXR interpretation threshold for asbestosis from the 1986 Statement to the '04 ATS Statement. The new Statement or guidelines stress "structural pathology consistent with asbestos related disease as documented by imaging or pathology." The Statement suggests, "...at a minimum a baseline, high quality chest film should be obtained." The '04 guidelines then make a significant departure from the '86 guidelines suggesting that the threshold for small irregular opacities be lowered from 1/1 to 1/0 to be considered positive for asbestosis. The new Statement reads as follows:

"A critical distinction is made between films that are suggestive but not presumptively diagnostic (0/1) and those that are presumptively diagnostic but not unequivocal (1/0). This dividing point is generally taken to separate films that are considered to be 'positive' for asbestosis from those that are considered to be 'negative.' However, profusion itself is continuous." This transition from 1/1 to 1/0, while seemingly a subtle subcategory modification, is a sea change in interpretation requiring arbitrary and frequently difficult decisions by B-readers with far-reaching ramifications. Of the Statement's 11 contributors, only one is registered as a B-reader (WR) although a European contributor is familiar with the system (GH). None of the contributors are radiologists however. As a radiologist, I find it curious that physicians with limited training in radiology are making recommendations in the statement involving nuances in radiographic interpretation.

**b. Questionable Support for the '04 Threshold**

As pointed out in one of the published letters criticizing the Statement, the reduction from the '86 threshold of 1/1 to 1/0 is not explained and is arbitrary.<sup>(42)</sup> Two references are cited for the quoted text above. The first is an article published in 1997 reviewing the clinical predictors of mortality in a large population of heavily exposed asbestos workers from 1981-1983<sup>(21)</sup>. A single B-reader "expert" arbitrarily determined that the threshold for positivity was 1/0 in a population with heavy asbestos exposure. The article cites the *1980 ILO Guidelines* but misquotes the document and fails to recognize Explanatory Note #8 from the *1980 ILO Guidelines* which suggests that the 0/1 and 1/0 subcategories may be used to represent "suspect" pneumoconiosis, rather than positive for pneumoconiosis. This first reference, while informative in many ways, misstates the *1980 ILO Guidelines* and does not provide a substantive rationale for the transition from the 1/1 threshold recommended in the 1986 ATS Statement to the 1/0 threshold suggested by the 2004 ATS Statement.

The second reference cited in support of the threshold reduction from 1/1 to 1/0 in the 04 Statement is designated the *ILO International Classification of Radiographs of Pneumoconioses, 2003*. This document is more accurately designated as the *Guidelines for the Use of the ILO International Classification of Radiographs of Pneumoconioses, Revised Edition 2000*<sup>(6)</sup>. There is no publication with the 2003 designation.

The *2000 ILO Guidelines* includes the following: "Subcategory 0/0 refers to radiographs where there are no small opacities or if a few are thought to be present, they are not sufficiently definite or numerous for category 1 to have been seriously considered as an alternative. Subcategory 0/1 is used for radiographs classified as category 0 after having seriously considered category 1 as an alternative. Subcategory 1/0 is used for radiographs classified as category 1 after having seriously considered category 0 as an alternative"<sup>(6)</sup>. Therefore, the subcategory 1/0

introduces the serious consideration that the CXR may be normal. It should also be noted however that "the subcategories are arbitrary divisions of an underlying continuum of increasing profusion of small opacities" <sup>(6)</sup>.

**c. Reliability of the 1/0 Threshold**

The designation of category 1 implies the presence of small opacities. However, the determination of the subcategory 1/0 can be very difficult. I have attended discussions and indeed national meetings where participants, experienced in the ILO system for classifying CXRs, have argued vehemently over classifying CXRs 1/0 vs. 0/1. Are there workers CXRs that could and should be classified as category 1/0? The answer is probably yes, but the issue is not that simple. First of all, the subcategories that fall between the major categories are arbitrary. The minor or subcategories do not represent equal points on an ordinal scale, but rather are descriptions of the radiographs, describing the reader's degree of certainty of assignment to a major category <sup>(51)</sup>. There are 0/0 and 1/1 standards for comparison of the workers CXRs. There is no 1/0 standard CXR for comparison. Each B-reader arbitrarily decides what 1/0 looks like on the CXR he or she is classifying. The normal CXR presents multiple small linear and irregular opacities due to branching blood vessels. Detecting the abnormal small irregular opacities from the background of normal linear and irregular opacities is challenging especially at low profusions such as the 1/0 subcategory. Thus there is controversy and frequent difficulty in separating the 0/1 subcategory CXR from the 1/0 subcategory CXR.

**d. Intra- and Inter-Reader Variability and Objectivity**

There is a great deal written regarding the inter-reader and the intra-reader variability in the application of the ILO system for film classification. There are many explanations for the variability such as experience, the availability of the ILO standards, film quality, geography, and perhaps clinical bias. In 1990, a survey of B-reader candidates indicated that approximately 70%

were reading between 0 and 10 films per month for pneumoconioses <sup>(2)</sup>. At this level of activity, maintaining familiarity with the classification system or the subtle radiographic signs of pneumoconioses would be a challenge. Classifying CXRs for pneumoconioses without using the standard radiographs is fraught with hazard. It has always intrigued me how readers who classify numerous CXRs with a high level of abnormality in a single day have time to use the standards. The background of small opacities a B-reader "sees" normally in his or her practice could also influence their threshold for abnormality. Several studies have compared B-readers from differing parts of the country, coastal versus central areas, American versus British, American versus Canadian, American versus Chinese, etc. At least part of these documented variations in classification relate to the non-occupational background opacities normally seen by the various readers. These opacities are attributed to smoking, age, gender, and geography <sup>(2, 52, 60, 53, 59, 55, 66, 50, 58)</sup>. Air pollution, other toxins, and very likely drugs contribute as well. Thus, the threshold for subtle or early lung changes caused by pneumoconiosis will vary. The greatest inter-reader variability seems to occur at the lowest profusions showing the earliest radiographic changes <sup>(65)</sup>.

Studies have shown that the attitude or perspective of the reader may have an impact on reader variability <sup>(2, 11, 66)</sup>. Physicians are advocates for their patients. The aim is to make a diagnosis or contribute to the care process or alleviate the symptoms. When using the ILO system, emphasis is on specific observations and strict classification while diagnosis plays a lesser role. This raises conflicts for some readers and is a source of variability.

Objectivity is difficult to maintain when reading and classifying CXRs for pneumoconiosis. It is hard to construct a situation for CXR reading when some bias is not present. Simply asking the reader to complete a B-reader form for a given CXR introduces some degree of bias. In reviewing the various scientific papers for this report, I was struck by a

recurring theme. Many of the papers described cohorts of asbestos exposed workers from many years ago, some as early as the '60's, even though the reports appeared much later. The workers were frequently heavily exposed and had been recruited to the various studies by the researchers with this knowledge or at least that strong likelihood based on occupational history. CXRs were obtained as part of their evaluations and subsequently classified. Very few studies mixed in CXRs from non-asbestos exposed individuals as controls. It is interesting to ponder the outcome of these studies had the CXRs been interpreted by readers with no knowledge of the workers' occupational history and mixed with control CXRs from non-exposed workers. The clinical and research environments that are the basis for many of the recommendations for worker evaluation and diagnosis are an entirely different situation from the screening company generated claims of today.

## **VI. Recommendations**

W. R. Grace is confronted by a large number of asbestos claims and a system of litigant recruitment and evaluation that may be very flawed. The goal remains the same: develop a system of evaluation that identifies those individuals with asbestos related pulmonary disorders and compensate them appropriately and minimize the compensation of those without substantive claims. The words of Dr. Crapo seem appropriate: "Distinguishing non-asbestos related cases from those caused by asbestos exposure, based on scientific and medical standards, is an important element in setting up a valid trust"<sup>(41)</sup>. The key phrase is "scientific and medical standards" which appear to be somewhat of a moving target based on recent experiences. Given the medical evaluation tools at hand, the remedy lies in rediscovering their credibility. But, not only must their applications be credible in meeting scientific and medical standards, the evaluation tools and their results must be reliable.

### **A. Acquiring Good Quality Chest X-Rays**

The goal is to utilize a process for the review of asbestos claims based on reliable, scientific, medical data so that individuals with significant injury and impairment from exposure receive appropriate compensation while compensation of invalid claims is minimized. It is apparent that there are serious problems with screening company produced CXRs to determine the presence of asbestos related disorders. It seems likely that the worker recruitment and evaluation process is being manipulated, the interpretation process may be tainted, and the credibility of the evaluation process and evaluation tools jeopardized. The subtleness of the early radiographic findings of asbestos related disorders plays into the hands of those who use substandard radiographic equipment, lack appropriate training and quality control of their efforts, and knowingly or unknowingly manipulate the quality of the CXR images to favor subtle abnormality and positivity. Policing the many screening ventures would be very difficult. A reasonable alternative would be to utilize existing health care facilities with contemporary high quality radiographic equipment as the resource for imaging (CXR) services. Using a facility providing radiographic services to a cross section of individuals and not just workers being screened for asbestos would more likely provide a higher level of quality. Specific sites that are screened for quality radiographic services could be selected geographically to be convenient to a large number of potential claimants. The CXR should be checked for quality by a trained radiologic technologist before the claimant leaves the premises so that the CXR can be repeated if necessary. This is a practice that goes on in hospitals and practices across the country each day. There are numerous references available that outline radiographic techniques to produce high quality images for evaluation of the pneumoconioses <sup>(12, 13)</sup>. It is essential that the control of film quality be removed from those who would benefit from a positive study or a reimbursable claim. The situation is too important to simply accept any CXR regardless of quality and attempt

to classify it for pneumoconioses. Quality control at the front end of the medical data gathering process is essential. All parties concerned benefit from high quality and accurate information, especially the claimant.

**B. Legacy Claims with Existing Chest X-Rays**

For those individuals who already have CXRs, there must be a quality assessment to ensure that the films are of sufficient quality to enable reliable reads. CXRs that are of grade 1 or 2 should be read by two or three independent B-readers. It is crucial to have replicated reads that are independent as stated in the ILO Guidelines. Moreover, the CXRs should be original films, not copies. For those individuals whose films are not grade 1 or 2, those individuals should have their x-rays retaken. In the interest of generating consistent quality CXRs, there should be a list of agreed upon facilities, in different locations across the country, to enable each person to go to a convenient facility that can generate a quality CXR.

**C. Individual and Independent B-Readers**

Each CXR, new or existing, must of course be interpreted and classified for pneumoconiosis by a certified B-reader. The current recommendation is for 3 different B-readers to classify each CXR, not as a panel but individually <sup>(6, 67, 68)</sup>. The readers must be entirely neutral and independent and certainly not in the employ of any party that benefits from any reading. Obviously the readers cannot be incentivised for volume or a particular classification. ILO standards must be employed at all times in the classification process. The readers should be blinded to other clinical data. Normal or control CXRs should be mingled with the claimants CXRs as a quality control device and inter-reader variability should be monitored. These steps should improve the integrity of the process and promote the identification of reader outliers.

**D. The 1/1 Profusion Score, a More Reliable and Tested Threshold for Evidence of Early Disease**

Interstitial fibrosis or asbestosis is characterized on the CXR by small irregular or linear opacities predominantly at the lung bases. Detecting this process radiographically at an early stage is one of the most challenging of all interpretive maneuvers in chest radiology, regardless of their etiology. In addition, it is widely recognized that some individuals with interstitial fibrosis or early asbestosis may have normal CXRs with no detectable small opacities. For the latter group with normal CXRs, the diagnosis may not be able to be made clinically. For those with early disease, caution must be exercised since the radiographic features of asbestosis are not specific to that disease. In addition, certain variables have been identified that may lead to the development of slight linear irregular interstitial opacities in an unexposed population. These include smoking and age. Poor technique resulting in an underexposed CXR, an incomplete inspiration, obesity, and large breasts may contribute to over reading of linear opacities in the lung bases<sup>(57)</sup>. Smoking is a confounding factor in the early radiographic diagnosis of asbestosis. While this is a controversial issue, the ATS Statement that minimizes the effects of smoking suggests that at most, smoking may change the ILO profusion classification by no more than one subcategory<sup>(48, 49)</sup>. One subcategory can be a change from 0/1 to 1/0. What if the one-subcategory change moves the determination from "negative" to "positive" to paraphrase the ATS Statement? How is this to be addressed? I agree with the critics of the ATS Statement who suggest that the ATS is disregarding decades of investigation that provide the insight that cigarette smoking can confound the diagnosis of asbestosis and its own consensus statement on interstitial lung disease which recognizes smoking related interstitial lung disorders<sup>(45, 63)</sup>.

It is also evident that B-readers are in best agreement in classifying normal studies and those with higher profusions. The lower profusions provoke the most inter-reader variability<sup>(9, 51)</sup>. This underscores the potential for arbitrary determinations for subcategories not depicted by

standard films. As mentioned previously there is no 1/0 standard. There is also a statistically proven tendency for over reading CXRs approaching 20% among physician candidates taking the NIOSH certifying and recertifying B-reader examinations. This over reading tendency, or falsely classifying CXRs as positive, includes the distinction between subcategories 1/0 and 0/1.

Therefore, if non-exposed individuals can have small opacities, if smoking and age and obesity and male gender are factors related to these opacities, and if film quality can be manipulated to contribute to the erroneous interpretation of small opacities, and given the arbitrary definition of the subcategory 1/0 and the potential for confounding its appearance, and given the proven tendency for over reading at low profusions, the reliability of the 1/0 threshold proposed in the ATS Statement is very questionable. After reviewing the ATS Statement and the references cited to support this reduced threshold, I found no compelling scientific reason for this modification of the 1986 ATS Statement. I suggest that the 1/1 threshold be employed since: it has been used for many years; represents mild but definite disease: is supported by an ILO 1/1 standard and will therefore be less subject to arbitrary interpretations; and will be less likely to be confounded by contributions from background small opacities related to smoking, age and the other complicating factors. The arbitrary and non-specific nature of the 1/0 subcategory reading as positive for asbestosis has been recognized by the Florida Asbestos and Silica Compensation Act that demands a reading of 1/1 for positivity <sup>(7)</sup>. The 1/1 threshold is more reliable and was endorsed by the ATS for nearly 20 years.

If the 1/0 threshold is employed, it is likely that: a) there will be more difficulty in obtaining consensus among the B-readers; b) some individuals with background opacities of whatever etiology, unrelated to asbestos, will be found positive; c) and in further keeping with the ATS statement, all CXRs must be high quality. Although the ATS does not define "high

quality," consistent with the ILO Guidelines, this would suggest a grade 1 CXR. However, generating grade 1 CXRs requires great attention to detail and near perfect exposure conditions for the individual patient. It would be problematic to expect to generate grade 1 CXRs consistently for each individual. Furthermore, to address the arbitrary, by definition, designation of 1/0, additional imaging tools may be necessary to make the determination more reliable.

**E. Additional Chest Imaging Technologies**

Chest computed tomography (CT) and high-resolution chest CT (HRCT) have both been applied to the evaluation of pneumoconioses. Both tools are more sensitive for asbestos related lung and pleural abnormalities than the standard CXR. Neither tool is more specific than the CXR however. There are no widely accepted standards for the interpretation of Chest CTs or HRCT and none have the legacy or acceptance of the ILO Classification. These imaging studies are also considerably more expensive and not as readily available. Therefore their use in large studies or surveys of asbestos exposed workers is limited. These limitations have complicated the development and availability of accepted standards. However, there may be selected situations in which CT or HRCT can be employed as problem-solving tools. Their widespread application at this time is problematic.

**F. A Chest X-Ray is but One Tool for Assessing Disease**

Finally, the evaluation of claimants for asbestos related disorders requires more than CXRs or CT scans. The documented history of asbestos exposure, the latency period, the physical findings, pulmonary function tests, and perhaps other studies are all contributory. The abnormal CXR and its interpretation remain the most important factors in establishing the presence of interstitial fibrosis <sup>(5)</sup>. The integrity and credibility of these tools and this process must be reestablished in the asbestos litigation arena.

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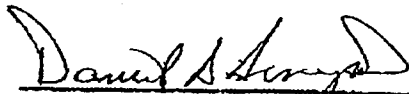
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62. Roggli VL. Scanning electron microscopic analysis of mineral fiber content of lung tissue in the evaluation of diffuse pulmonary fibrosis. *Scanning Microsc* 1991; 5:71-80.
63. American Thoracic Society/European Respiratory Society. American Thoracic Society/European Respiratory Society international multidisciplinary consensus classification of the idiopathic interstitial pneumonias. *Am J Respr Crit Care Med* 2002; 165:277-304.
64. Zitting AJ. Prevalence of radiographic small lung opacities and pleural abnormalities in a representative adult population sample. *Chest* 1995; 107:126-131.

65. Musch DC, Landis JR, Higgins IT, Gilson JC, Jones RN. An application of kappa-type analyses to interobserver variation in classifying chest radiographs for pneumoconiosis. *Stat Med.* 1984 Jan-Mar. 3(1):73-93.
66. Hilt B, Borgerson A, Lien JT, et al. Chest radiographs in subjects with asbestos related abnormalities: comparison between ILO categorizations and clinical reading. *Am J Ind Med* 1992; 21: 855-861.
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68. National Institute of Occupational Safety & Health. Chest Radiography: Classification of Chest Radiographs. Practices in Contested Proceedings. Draft topic page for comment and review; NIOSH docket #085, May 22, 2006.  
<http://www.cdc.gov/niosh/topics/chestradiography/contested-proceedings.html#factors4>



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Daniel A. Henry, M.D., F.A.C.R.

## **Exhibit A**

**CURRICULUM VITAE**

**DANIEL ANTHONY HENRY, M.D.**

**PERSONAL INFORMATION:**

Date and Place of Birth:	August 5, 1944, St. Louis, MO
Citizenship:	United States
Social Security Number:	494-46-2654
Marital Status:	Married, two children
Home Address and Phone:	14441 Leaffield Drive Midlothian, Virginia 23113 (804) 794-7692
Office Address and Phone:	Medical College of Virginia Hospitals/ VCU Medical Center Department of Radiology Main Hospital, 3 <sup>rd</sup> Floor 1250 E. Marshall St. PO Box 980615 Richmond, Virginia 23298-0615 (804) 828-5096 (804) 628-1132 (fax)

**LICENSURE:**

12/04/72-8/31/06	State and Number:
Issued 6/24/72 (Inactive)	Virginia, #22582
1972-present	Missouri, #34647
	National Board of Medical Examiners, #129256
June, 1975	Board Certification:
	American Board of Radiology

**EDUCATION:**

9/1967 – 6/1971	St. Louis University, School of Medicine, M.D.
9/1962 – 6/1966	St. Louis University, B.S.

**MILITARY SERVICE:**

Major, USAF MC, July 2, 1975 to July 1, 1977 (active duty)

Faculty, Department of Radiology, Chief, Section of Pediatric Radiology and Residency  
Training in Pediatric Radiology, Wilford Hall USAF Medical Center, Lackland AFB, Texas

**POST-DOCTORAL TRAINING:**

Chief Resident, Department of Radiology, Medical College of Virginia/Virginia Commonwealth  
University, April, 1974 to June, 1975

Mini-Fellowship, Armed Forces Institute of Pathology, Radiologic-Pathologic Correlation,  
January to March, 1974

Radiology Residency, Department of Radiology, Medical College of Virginia/Virginia  
Commonwealth University, July, 1972 to June, 1975

Straight Medicine Internship, St. Louis University Group Hospitals, July, 1971 to June, 1972

**ACADEMIC APPOINTMENTS:**

Director, Thoracic and Cardiac Radiology, Department of Radiology, Medical College of  
Virginia Hospitals/VCU Medical Center, July, 1998 to present

Associate Professor of Radiology, Division of Diagnostic Radiology, Department of Radiology,  
Medical College of Virginia/Virginia Commonwealth University, July, 1984 to present

Consultant in Radiology, McGuire Veterans Administration Hospital, Richmond, Virginia, July,  
1977 to present

Divisional Chairman, Division of Diagnostic Radiology, Department of Radiology, Medical  
College of Virginia/Virginia Commonwealth University, October, 1999 to July, 2001

Chairman, Division of Diagnostic Radiology, Department of Radiology, Medical College of  
Virginia/Virginia Commonwealth University, December, 1990 to April, 1998

Interim Chairman, Division of Diagnostic Radiology, Department of Radiology, Medical  
College of Virginia/Virginia Commonwealth University, July, 1989 to November, 1990

Director, Section of Chest Radiology, Division of Diagnostic Radiology, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, December, 1986 to June, 1989

Acting Chairman, Division of Diagnostic Radiology, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, April, 1983 to December, 1984

Assistant Professor of Radiology, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, Richmond, Virginia, July, 1977 to June, 1984

Director, Section of Chest Radiology, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, Richmond, Virginia, July, 1978 to August, 1984

Director, Radiology-Adult Section, E. G. Williams Hospital, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, Richmond, Virginia, July, 1978 to 1982

Chief, Section of Pediatric Radiology, Department of Radiology, Wilford Hall USAF Medical Center, Lackland AFB, Texas, July, 1975 to June, 1977

#### **SOCIETY MEMBERSHIPS:**

American College of Radiology (Fellow)  
Richmond Radiological Society  
Radiological Society of North America  
Society of Thoracic Radiology  
American Roentgen Ray Society  
Secretary-Treasurer, Richmond Radiological Society, 1990  
Vice President, Richmond Radiological Society, 1991  
President, Richmond Radiological Society, 1992

#### **SPECIAL AWARDS:**

Fellow, American College of Radiology, September, 1997 to present

Recipient, Letter of Recognition for Excellence in Teaching, from Housestaff, Department of Medicine, Medical College of Virginia/Virginia Commonwealth University, 1979 and 1980

Awarded "Honorable Mention" for exhibit: Multiple imaging evaluation of cardiovascular and tracheobronchial sarcoidosis by the Radiological Society of North America, Washington, DC, November, 1984 (See "Exhibits")

Awarded "Certificate of Merit" for exhibit: Orthotopic Cardiac Transplantation: Radiographic Evaluation, by Radiological Society of North America, Chicago, Illinois, November, 1987 (See "Exhibits")

Awarded "Silver Medal" for exhibit: Orthotopic Cardiac Transplantation: Radiographic Evaluation, by the American Roentgen Ray Society, San Francisco, California, May, 1988 (See "Exhibits")

Awarded "Certificate of Merit" for exhibit: The post-cardiac surgery chest radiograph: A clinically integrated approach, by the American Roentgen Ray Society, Washington, DC, May, 1990 (See "Exhibits")

Awarded funding for development of "Radiology Image Processing and Transmission System," Virginia State Council of Higher Education, \$430,000, August, 1992

Awarded \$92,000 for "Digital Imaging Network" from Siemens Medical Systems, 1992

Co-investigator, Technology Development for Digital Medical Imaging; user liaison for public programs and education, coordinator for Medical College of Virginia/Virginia Commonwealth University programs. Center for Innovative Technology, State of Virginia. J.R. Brookeman, Ph.D., Department of Radiology, University of Virginia, Principal Investigator. Award sought \$1,499,033, 1993. Approved but not funded.

Awarded \$150,000 for "Cardiac MR Research and Clinical Applications" Siemens Medical Systems, 1995

Editorial Advisory Panel, American Journal of Roentgenology, 1998 to present

Radiology Editor's Recognition Award for reviewing with "Distinction," 1998

Awarded \$10,000 for Cardiac MR Research in Patients Undergoing Radiofrequency Ablation for Atrial Fibrillation from Guidant Catheter Co.

Radiology Editor's Recognition Award for reviewing with "Distinction," 1999

Radiology Editor's Recognition Award for reviewing with "Distinction," 2000

"Recognition of Extraordinary Teaching and Dedication to Pulmonary Disease." Pulmonary Medicine and Critical Care Division, Department of Internal Medicine, and Virginia Commonwealth University Chest Physicians, December 4, 2002

#### **MAJOR COMMITTEES:**

Billing Committee Meeting, Radiology Department, MCV Hospitals/VCU Medical Center, June 2005 to present

Occupational Pulmonary Disease Committee, Medical College of Virginia/Virginia Commonwealth University, May 1998 to present

Member, Faculty Senate, Virginia Commonwealth University, 1981 to 1982

Quality Control Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1982 to 1983

Residency Evaluation Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1983

University Radiologists Executive Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1983

Nuclear Magnetic Resonance Investigation/Planning Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1983

Radiology Information Systems Planning Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1983

Credentials Committee, Medical College of Virginia/Virginia Commonwealth University, 1984 to 2001

Occupational Pulmonary Disease Committee, Medical College of Virginia/Virginia Commonwealth University, 1984 to 1995; 1998 to present

Medical School Curriculum Reform Steering Committee-MIV, Medical College of Virginia/Virginia Commonwealth University, 1986 to 1987

Member, Board of Directors, Virginia Commonwealth University Radiology Association, 1986 to 1987

Medical Care Evaluation Committee, Medical College of Virginia/ Virginia Commonwealth University, 1987 to 1995

Radiology Information Systems Planning Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1987 to 1993

Coordinator, Development and Implementation, Quality Assurance Program, Department of Radiology, Medical College of Virginia/ Virginia Commonwealth University, 1987 to 1998

Radiology Representative, Medical School AIDS Committee, Medical College of Virginia/Virginia Commonwealth University, 1988 to 1989

Elected to Faculty Caucus of the University Council as alternate, Virginia Commonwealth University, 1988 to 1990

Member, Respiratory Subject Matter Committee, School of Medicine, Medical College of Virginia/Virginia Commonwealth University, 1988 to 1990

Member, Board of Directors, Virginia Commonwealth University Radiology Association, 1989 to 1997

Trauma Care Committee, Medical College of Virginia/Virginia Commonwealth University, 1993

Emergency Medical Services Committee, Medical College of Virginia/ Virginia Commonwealth University, 1990 to 1992

Radiology Residency Selection Committee, Medical College of Virginia/Virginia Commonwealth University, 1989 to 2001

Practice Effectiveness Committee, Medical College of Virginia/ Virginia Commonwealth University, May 1990 to 1992

Safe Medical Device Task Force, Medical College of Virginia/Virginia Commonwealth University, 1991

Medical College of Virginia Associated Physicians Malpractice Claims Review Committee, Medical College of Virginia/Virginia Commonwealth University, 1992 to 1995

Safe Medical Device Multidisciplinary Committee, Medical College of Virginia/Virginia Commonwealth University, 1991 to 1992

Continuous Quality Improvement Team: ER process of care evaluation, Medical College of Virginia/Virginia Commonwealth University, August 1992 - March 1994

Medical Center Strategic Planning Committee for Internal Cooperation, Medical College of Virginia/Virginia Commonwealth University, 1992

Medical Center Strategic Planning Committee for Faculty Performance Evaluation (Chairman), Medical College of Virginia/Virginia Commonwealth University, 1992

Medical Center Reengineering Task Force on Diagnostics, Medical College of Virginia/Virginia Commonwealth University, August, 1994 to February, 1995

Medical College of Virginia Associated Physicians Clinical Practice Committee, Medical College of Virginia/Virginia Commonwealth University, 1995 to 1999

Medical College of Virginia Hospital Radiology Patient Care Committee, Chairman, Medical College of Virginia/Virginia Commonwealth University, 1996 to 1998

Emergency Admissions Review and Transition Help Committee, Medical College of Virginia/Virginia Commonwealth University, 1996

Emergency Admissions Review Transition Help Sub-Committee for Diagnostics, Medical College of Virginia/Virginia Commonwealth University, 1996

Department of Emergency Medicine/Radiology Process Action Team, Medical College of Virginia/Virginia Commonwealth University, 1996

Department of Emergency Medicine/Radiology Utilization Review Committee, Medical College of Virginia/Virginia Commonwealth University, 1996

Stony Point Executive Council Committee, Medical College of Virginia/Virginia Commonwealth University, 1996 to 1998

Search Committee Member, Office of Vice Provost for Information Technology, Virginia Commonwealth University, October, 1996

Interim Chair, Credentials Committee, Medical College of Virginia/Virginia Commonwealth University, December, June, 1998 to October, 1998; Committee member through June 30, 2000

Radiology Residency Evaluation Committee, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 1999 to 2001

Departmental Executive Committee, 1999 to 2001

Radiology Department Operations Committee, 2000 to 2001

**OTHER SIGNIFICANT SCHOLARLY, RESEARCH OR ADMINISTRATIVE EXPERIENCE:**

Continuous Quality Improvement Training, Medical College of Virginia/Virginia Commonwealth University, August, 1992

Counselor, Radiological Society of North America, 1991 to 1997

Member, Editorial Board and Chairman, selection panel for Chest Imaging for RadioGraphics, January, 1987 to 1990

Designated "A" Reader, Department of Health and Human Services, National Institute of Occupational Safety and Health, December, 1981 to July, 1985

Designated "B" Reader, Department of Health and Human Services, National Institute of Occupational Safety and Health, July 1, 1985. Recertified: 1989, 1993, 1997, 2001

Member, American College of Radiology Task Force on Pneumoconiosis of the Commission on Education, July, 1990 to present

Member, American College of Radiology Program Committee of the Task Force on Pneumoconiosis, July, 1990 to present

Manuscript Reviewer, RadioGraphics, 1987 to present

Manuscript Reviewer, Clinical Imaging, 1990 to present

Manuscript Reviewer, Journal of Thoracic Imaging, 1994 to present

Manuscript Reviewer, American Journal of Roentgenology, 1995 to present

Manuscript Reviewer, Radiology, 1997 to present

Appointed to Editorial Advisory Panel, American Journal of Roentgenology, 1998 to present

Appointed Section Editor, Section III, for Imaging, In Ayers S, Grenvik A, Holbrook P, Shoemaker W: Textbook of Critical Care, 4<sup>th</sup> edition

Chairman, American College of Radiology Task Force on Pneumoconiosis of the Commission on Education, 2004 to present

## **BIBLIOGRAPHY**

### **PAPERS:**

1. Roth FJ, Ranniger K, Beachley MC and Henry DA: Angiographic demonstration of a primary sarcoma of the pulmonary artery. Fortshr, GEB, Roentgenstr Nuklearmed, 1975; 22 (1):47-50.
2. Dietzler DN, Leckie M, Lais CJ, Henry DA, Rothert JH and Ferguson RM: Periodic inventory review as a strategy for survival in Escherichia Coli. J Biol Chem 1979; 254 (17):8288-8294.
3. LaSalle AJ, Andrassy RJ, Page CP, Henry DA and Buckley CJ: Intussusception of the appendiceal stump. Clin Ped 1980; 19 (6) 432-435.
4. Henry DA: Pulmonary cysts in progressive systemic sclerosis (Scleroderma). Revista Interamericana de Radiologica 1980;5:113-116.
5. Cho SR, Henry DA and Beachley MC: Round (helical) atelectasis. Br J Radiol 1981; 54:643-650.
6. Cho SR, Henry DA, Shaw CI and Liu CI: Vanishing esophageal intraluminal diverticulum. G.I. Radiol 1982; 7:315-317.

7. Cho SR, Turner MA and Henry DA: Diabetic gastric neuropathy- gastroparesis diabeticorum. J Can Assoc Rad 1983; 34:32-35.
8. Cho SR, Henry DA, Schneider V, Turner MA: Polypoid carcinoma of the esophagus: a distinct radiological and histopatho- logical entity. Am J Gastroenterol 1983; 78:476-480.
9. Henry DA and Cho SR: Tracheal stenosis in sarcoid. South Med J 1983; 76:1323-1324.
10. Lewis TD and Henry DA: Needle embolus: A unique complication of drug abuse. Ann Emerg Med 1985; 14:906-908.
11. Henry D, Kiser P, Scheer C, Cho S, Tisnado J: Multiple Imaging Evaluation of Sarcoidosis: I. Airway Involvement. RadioGraphics 1986; 6:75-85. II. Cardiovascular Involvement. RadioGraphics 1986; 6:85-95.
12. Henry D, LeBolt S: Invasive hemodynamic monitoring: Radiologist's perspective. RadioGraphics 1986; 6:535-572.
13. Cho SR, Tisnado J, Cockrell C, Beachley M, Fratkin M, Henry D: Angiographic evaluation of patients with unilateral massive perfusion defects on lung scan. RadioGraphics 1987; 7:729-745.
14. Robinson J, Knoll R, Henry D: Intrathoracic granular cell myoblastoma: Southern Medical Journal, 1988; 81:1453-1457.
15. Jolles H, Henry D, Rupp S: RSNA case of the day. Cor Triatriatum. RadioGraphics 1988; 8:1227-1231.
16. Henry D, Corcoran H, Lewis T, Barnhart G, Szentpetery S, Lower R: Orthotopic cardiac transplantation: Evaluation with CT. Radiology, 1989; 170:343-350.
17. Henry D, Jolles H, Berberich J, Schmelzer V: The post cardiac surgery chest radiograph: A clinically integrated approach. J Thorac Imag, 1989; 4(3): 20-41.
18. Henry DA: Uninvited guests: Cardiovascular foreign bodies. New York J Med 1990, 90:347-48.
19. Sabri MN, Henry DA, Wechsler AS, Disciascio G, Vetrovec GW: Late complications involving the ascending aorta after cardiac surgery - recognition and management. Amer Heart J, 1991; 121:1779-1783.
20. Bousamra M, Olak J, Henry DA, Wechsler AS: Vascular lesions of the mediastinum. Chest Surgery Clinics of North America, 1992; 2:57-88.

21. Byrne K, Tatum J, Henry DA, Crossland M, Barnes T, Hirsch J, Thompson JA, Young J, Sugerman HJ: Increased morbidity with increased pulmonary albumin flux in septic adult respiratory distress syndrome. *Critical Care Medicine*, 1992; 20:28-35.
22. Cole T, Henry D, Jolles H, Proto A: Normal and abnormal vascular structures that simulate neoplasms on chest radiographs: Clues to diagnosis. *Radiographics*, 1995; 15: 867-891.
23. Simonetti O, Finn P, White R, Laub G, Henry D: "Black Blood" t2-weighted Inversion - Recovery MR Imaging of the Heart. *Radiology*, 1996; 199:49-57.
24. Jolles H, Henry D, Roberson J, Cole T, Spratt J. Mediastinitis Following Median Sternotomy: CT findings. *Radiology*, 1996; 201:463-466.
25. Henry DA. Chest Imaging in the Neurosciences Intensive Care Unit. *Respiratory Care*, 1999; 44:1064-1078.
26. Henry DA. International Labor Office Classification System in the Age of Imaging: Relevant or Redundant? *J Thorac Imag*, 2002; 17(3):179-188.
27. Wood MA, Wittkamp M, Henry DA, Martin R, Nixon JV, Shepard RK, Ellenbogen KA: A Comparison of Pulmonary Vein Ostial Anatomy by Computerized Tomography, Echocardiography, and Venography in Patients with Atrial Fibrillation Having Radiofrequency Catheter Ablation. *Am J Cardiol* 2004; 93:49-53.
28. Okum E, Henry D, Kasirajan V, DeAnda A: Cardiac Pheochromocytoma. *J Thorac and Cardiovasc Surg* 2005; 129:674-5.
29. DeAnda A, Kasirajan V, Henry D, Meyers S: Complete Regression of an Intramural Hematoma of the Aorta Following Distal Reperfusion. *J Vasc Surg* 2005; 42:149-52.

#### ABSTRACTS:

1. Cho SR, Henry DA, Beachley MC and Brooks JW: Round (helical) atelectasis. *Radiology* 142:816, March, 1982
2. Cho SR, Henry DA, Shaw CI, et al: Vanishing intraluminal diverticulum of the esophagus. *Act Internat de Gastro-entero* 4:193, 1983
3. Kiser PE, Henry DA, Scheer CE, Cho SR, Tisnado J: Multiple imaging evaluation of tracheobronchial and cardiovascular sarcoidosis. *Radiology* 153 (p) 353, November, 1984
4. Henry D, Lebolt S: Invasive hemodynamic monitoring: Radiologist's perspective. *Radiology* 157 (p) 351, 1985

5. Henry D, Prasad U: Right upper lobectomy: Apical fissure realignment. Radiology 161 (p) 237, 1986
6. Tisnado J, Cho SR, Beachley M, Henry D: Complications of central venous pressure catheter placement. Radiology 161 (p) 399, 1986
7. Cho SR, Tisnado J, Cockrell C, Beachley M, Fratkin M, Henry D: Angiographic evaluation of patients with unilateral massive perfusion defects on the lung scan. Radiology 161 (p) 395, 1986
8. Henry D, Corcoran H, Lewis T: Orthotopic cardiac trans-plantation: Evaluation with CT. Radiology 165 (p) 82, 1987
9. Henry D, Lewis T, Corcoran H, Proto A: Orthotopic cardiac transplantation: Radiographic evaluation. Radiology 165 (p) 393, 1987
10. Henry DA, Jolles H, Berberich JJ, Schmelzer V: The post- cardiac surgery chest radiograph: a clinically integrated approach. Radiology 173 (p) 456, 1989
11. Henry DA, Jolles H, Berberich JJ, Schmelzer V: The post- cardiac surgery chest radiograph: a clinically integrated approach. Year Book of Diagnostic Radiology, 1991
12. Henry DA: Imaging of critically ill patients: Radiology of the patient after cardiac surgery. Radiology 189 (p) 86, 1993
13. Henry DA: Imaging of critically ill patients. Radiologic Critical Care: Clinically Focused. Radiology 193 (p) 47, 1994
14. Henry DA, Blinder R, Finn P, Simonetti O: Breath-held Cardiac MR Imaging. Radiology 193 (p) 380, 1994
15. Simonetti O, Finn P, Henry D, Laub G: Motion - artifact - free STIR Imaging of the Heart. Radiology 193 (p) 160, 1994
16. Cole T, Henry D, Jolles H, Proto A: Normal and abnormal vascular structures that simulate neoplasms on chest radiographs: Clues to diagnosis. Radiology 193 (p) 415, 1994
17. Jolles H, Henry D, Roberson J, Cole T, Spratt J: Mediastinitis: Radiologic Facts and Fiction. Radiology 193 (p) 417, 1994
18. Henry DA: Imaging of critically ill patients. Radiology 197 (p) 95, 1995
19. Jolles H, Henry D, Cole T: Clinically driven priority system for portable chest radiography. Radiology 201 (p) 479, 1996

**BOOKS AND MONOGRAPHS:**

1. Henry DA: Thoracic sarcoidosis. Syllabus, 17th Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University: Chest Radiology, 36-37, March, 1981
2. Henry DA: Chest Trauma. Syllabus, 17th Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University: Chest Radiology, 60-62, March, 1981
3. Henry DA: Computed tomography of the chest. Syllabus, Winter Retreat: Update on Pulmonary Disorders, Department of Medicine, Medical College of Virginia/Virginia Commonwealth University, 27-36, February, 1984
4. Henry DA: Thoracic trauma: Radiologic triage of the chest radiograph. In: Proto A, Greene R, eds. Syllabus, Categorical course on Chest Radiology. American Roentgen Ray Society, 1986; 13-22
5. Henry DA: Thoracic manifestations of AIDS. Syllabus, 22nd Annual Radiology Postgraduate Course. Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, 57-65, May, 1986
6. Henry DA: The Swan-Ganz catheter: What the radiologist needs to know. Syllabus, Annual Postgraduate Course, Thoracic imaging. Society of Thoracic Radiology, 107-109, February, 1987
7. Henry DA: The Swan-Ganz catheter: Radiologic evaluation. Syllabus, 23rd Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University. The Chest, 103-105, April, 1987
8. Henry DA: Chest Trauma. Syllabus, 23rd Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University. The Chest, 53-66, April, 1987
9. Henry DA: Acute care chest radiography. Syllabus, Emergency medicine for the primary care physician, Department of Surgery, Medical College of Virginia/Virginia Commonwealth University. April, 1987
10. Henry DA: The post-cardiac surgery chest radiograph. Syllabus, Thoracic Imaging, Annual Postgraduate Course, Society of Thoracic Radiology. May, 1991
11. Coppage L, Jolles H, Henry DA. Imaging of the Chest in the Intensive Care Setting, In Ayers S, Grenvik A, Holbrook P, Shoemaker W: Textbook of Critical Care, 3rd Edition. W.B. Saunders, Philadelphia, 1995, 332-346

12. Henry DA: CQI and the process of portable chest radiography. Syllabus. Thoracic Imaging, 1995, Society of Thoracic Radiology, 1995, 387-389
13. Henry DA: Radiologic evaluation of the patient following cardiac surgery. In Goodman L, Kuzo R. Critical Care Chest Radiography, Radiologic Clinics of North America, W. B. Saunders, Philadelphia, 1996, 34(1):119-135
14. Henry DA: Pulmonary Radiology in the Critical Care Patient Unit by Unit: The Neurosurgery ICU. Syllabus. Thoracic Imaging 1998, Society of Thoracic Radiology, 1998, 609-611
15. Jolles H, Henry DA, Coppage L, Cole T: Critical Care Imaging of the Chest, In Ayers S, Grenvik A, Holbrook P, Shoemaker W: Textbook of Critical Care, 4<sup>th</sup> edition. W.B. Saunders, Philadelphia, 2000, 397-417
16. Henry DA: Section Editor for Imaging, In Ayres S, Grenvik A, Holbrook P, Shoemaker W: Textbook of Critical Care, 4<sup>th</sup> edition. W.B. Saunders, Philadelphia, 2000, 392-506
17. Henry DA: Imaging in the New Millennium, In Critical Care Clinics, ICU Bedside Technology, a Look into the 21<sup>st</sup> Century. Halpern N, Pastores S, Cropello J (eds). W.B. Saunders, Philadelphia, 2000, 16:4:579-599

#### SCIENTIFIC EXHIBITS:

1. Henry DA and Beachley MC: Intravascular air in the neonate, presented to the Radiological Society of North America, Dallas, Texas, November, 1980.
2. Henry DA and Beachley MC: Intravascular air in the neonate, presented to the American Roentgen Ray Society, San Francisco, California, March, 1981.
3. Kiser PA, Henry DA, Cho SR and Tisnado J: Multiple imaging evaluations of cardiovascular and tracheobronchial sarcoidosis, presented to the American Roentgen Ray Society, Las Vegas, Nevada, April, 1984.
4. Kiser PA, Henry DA, Cho SR and Tisnado J: Multiple imaging evaluations of cardiovascular and tracheobronchial sarcoidosis, presented to the Radiological Society of North America, Washington, D.C., November, 1984, Awarded Honorable Mention.
5. Cho SR, Tisnado J, Cockrell CH, Beachley MC, Fratkin MJ, Henry DA, Kiser PE: Angiographic evaluation of patients with unilateral massive perfusion defects in the lung scan, presented to the American Roentgen Ray Society, Boston, Massachusetts, April, 1985.
6. Cho SR, Tisnado J, Cockrell CH, Beachley MC, Fratkin MJ, Henry DA, Kiser PE: Angiographic evaluation of patients with unilateral massive perfusion defects in the lung scan, presented to the International Congress of Radiology, Honolulu, Hawaii, July, 1985.

7. Henry D, LeBolt S: Invasive Hemodynamic monitoring: Radiologist's perspective. Presented to the Radiological Society of North America, Chicago, Ill, November, 1985.
8. Henry D, LeBolt S: Invasive Hemodynamic monitoring: Radiologist's perspective. Presented to the American Roentgen Ray Society, Washington, D.C., April, 1986.
9. Cho SR, Tisnado J, Cockrell CH, Beachley MC, Fratkin MJ, Henry D: Angiographic evaluation of patients with unilateral massive perfusion defects in lung scan. Presented to the Canadian Association of Radiologists, Halifax, N.S., June, 1986.
10. Cho SR, Tisnado J, Cockrell CH, Beachley MC, Fratkin MJ, Henry D: Angiographic evaluation of patients with unilateral massive perfusion defects in lung scan. Presented to the Radiologic Society of North America, Chicago, Ill, December, 1986.
11. Tisnado J, Cho SR, Beachley M, Henry D: Complications of central venous pressure catheter placement. Presented to the Radiologic Society of North America, Chicago, Ill, December, 1986.
12. Cho SR, Tisnado J, Beachley M, Henry D: Complications of central venous pressure catheter placement. Presented to the American Roentgen Ray Society, Miami, Florida, May, 1987.
13. Cho SR, Tisnado J, Beachley M, Henry D: Complications of central venous pressure catheter placement. Presented to the Canadian Association of Radiologists, Ottawa, Ontario, June, 1987.
14. Henry DA, Lewis TD, Corcoran HL, Proto AV: Orthotopic cardiac transplantation: Radiographic evaluation. Presented to the Radiological Society of North America and awarded "Certificate of Merit," Chicago, Illinois, November, 1987.
15. Henry DA, Lewis TD, Corcoran HL, Proto AV: Orthotopic cardiac transplantation: Radiographic evaluation. Presented to the American Ray Society and awarded the "Silver Medal," San Francisco, California, May, 1988.
16. Henry DA, Jolles H, Berberich JJ, Schmelzer V: The post-cardiac surgery chest radiograph: a clinically integrated approach. Presented to the Radiologic Society of North America, Chicago, Illinois, November, 1989.
17. Henry DA, Jolles H, Berberich JJ, Schmelzer V: The post- cardiac surgery chest radiograph: a clinically integrated approach. Presented to the American Roentgen Ray Society, Washington, D.C., May, 1990.
18. Henry D, Blinder R, Finn P, Simonetti O. Breath-held Cardiac MR Imaging. Presented to the Radiological Society North America, Chicago, Illinois, November, 1994.

19. Cole T, Henry D, Jolles H, Proto A: Normal and abnormal vascular structures that simulate neoplasms on chest radiographs: Clues to diagnosis. Presented to the Radiologic Society of North America, Chicago, Illinois, November, 1994.
20. Jolles H, Henry D, Roberson J, Cole T, Spratt J: Mediastinitis: Radiologic Facts and Fiction. Presented to the Radiological Society of North America, Chicago, Illinois, November, 1994.
21. Jolles H, Henry D, Cole T: Clinically driven priority system for portable chest radiography. Presented to the Radiological Society of North America, Chicago, Illinois, December, 1996.
22. Henry D, Shaw de Paredes E, Narla L, Turner M, May D, Smoker W, Tisnado J: What a Great Teaching Case! Seven Academic Radiologists Share Memorable Cases. Presented to the Radiological Society of North America, Chicago, Illinois, December, 2001.

#### **PAPERS PRESENTED:**

1. Henry DA: Helical (round) Atelectasis, presented to the Virginia Chapter of the American College of Radiology, Hot Springs, Virginia, May, 1980.
2. Henry DA: Intravascular air in the neonate, presented to the Virginia Chapter of the American College of Radiology, Williamsburg, Virginia, May, 1981.
3. Henry DA: Post thromboembolic pulmonary edema: A study of focal and asymmetric edema patterns, presented to the Society of Thoracic Radiology, Newport Beach, California, February, 1986.
4. Henry DA: Right upper lobectomy: Apical fissure realignment. Presented to the Radiologic Society of North America, Chicago, Ill, December, 1986.
5. Henry DA: Thoracic computed tomography following cardiac transplantation. Presented to the Society of Thoracic Radiology, Orlando, Florida, February, 1987.
6. Henry DA: Orthotopic cardiac transplantation: Evaluation with CT. Presented to the Radiological Society of North America, Chicago, Illinois, November, 1987.
7. Henry DA, Jolles H, Barnett M: The cardiopulmonary bypass pseudo nodule. Presented to the Society of Thoracic Radiology, Naples, Florida, January, 1990.
8. Simonetti O, Finn P, Henry D, Laub G: Motion - artifact - free STIR Imaging of the Head. Presented to the Radiological Society of North America, Chicago, Illinois, November, 1994.
9. Mulvaney J, Cothran S, Henry D: Design Concept for Radiology Archive on the IBM Digital Library. Presented to the International Society for Optical Engineering, Newport Beach, CA, February, 1997.

10. Mulvaney J, Cothran S, Henry D: Clinical PACS using ATM for local and wide area networks. Presented to the International Society for Optical Engineering, Newport Beach, CA, February, 1997.
11. Ellenbogen K, Henry D, Wood M, Calkins H, Kay G, Hall J: Cardiac Magnetic Resonance Imaging (MRI) findings after right sided catheter maze procedures for atrial fibrillation using phased radiofrequency (RF) emergency. Presented to the American Heart Association, Atlanta, GA, October, 1999.
12. DeAnda A, Kasirajan V, Henry D, Meyers S: Complete Regression of an Intramural Hematoma of the Aorta Following Distal Reperfusion. Presented at the 29<sup>th</sup> Annual Meeting for the Southern Association for Vascular Surgery, Marco Island, FL, January 19-22, 2005.

**INVITED LECTURES:**

1. Henry DA: Mediastinum: A Radiologic Approach, Blackstone Family Practice Clinic, Blackstone, Virginia, March, 1979
2. Henry DA: Pulmonary Sarcoidosis, 17th Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, Williamsburg, Virginia, March, 1981
3. Henry DA: Chest Trauma, 17th Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, Williamsburg, Virginia, March, 1981
4. Henry DA: Thoracic Sarcoid - A Radiological Approach for Non-radiologists, Blackstone Family Practice Clinic, Blackstone, Virginia, April, 1981
5. Henry DA: A Targeted Approach to Chest Trauma, Richmond Radiologic Society, Richmond, Virginia, May, 1981
6. Henry DA: Thoracic Sarcoidosis - Old and New. Grand Rounds, McGuire Veterans Administration Hospital, Richmond, Virginia, November, 1981
7. Henry DA: Panelist, Pulmonary Case Conference, 30th Annual Conference on Pulmonary Disease, Virginia Thoracic Society, Arlington, Virginia, September, 1982
8. Henry DA: Computed Tomography of the Chest, Winter Retreat: Update on Pulmonary Disorders, Department of Medicine, Medical College of Virginia/Virginia Commonwealth University, Wintergreen, Virginia, February, 1984
9. Henry DA: Workshop on Intensive Care Radiology, Society of Thoracic Radiology, Newport Beach, California, February, 1986

10. Henry DA: Chest Trauma: Triage of the Chest Radiograph. Categorical course on Chest Radiology, American Roentgen Ray Society, Washington, DC, April, 1986
11. Henry DA: Thoracic Manifestations of AIDS. 22nd Annual Post-graduate Course in Radiology. Department of Radiology, Medical College of Virginia/Virginia Commonwealth University, Williamsburg, VA, May 1986
12. Henry DA: The Swan-Ganz Catheter. What the Radiologist Needs to Know. Annual Postgraduate Course in Thoracic Imaging, Society of Thoracic Radiology, Orlando, Florida, February, 1987
13. Henry DA: Chest Trauma. 23rd Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University. The Chest, Richmond, Virginia, April, 1987
14. Henry DA: The Swan-Ganz Catheter. Radiologic evaluation. 23rd Annual Radiology Postgraduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University. The Chest, Richmond, Virginia, April, 1987
15. Henry DA: Post Thromboembolic Edema. A Study of Focal and Asymmetric Edema Patterns. 23rd Annual Radiology Post-graduate Course, Department of Radiology, Medical College of Virginia/Virginia Commonwealth University. The Chest, Richmond, Virginia, April, 1987
16. Henry DA: Acute Care Chest Radiography. Emergency Medicine for the Primary Care Physician, Department of Surgery, Medical College of Virginia/Virginia Commonwealth University, Williamsburg, Virginia, April, 1987
17. Henry DA: Hemodynamic Invasive Monitoring. Radiologist's perspective. Department of Radiology, University of Florida, Jacksonville, November 17, 1988
18. Henry DA: Chest Trauma. Triage of the Chest Radiograph. Department of Radiology, University of Florida, Jacksonville, November 17, 1988
19. Henry DA: Radiographic Staging of Lung Cancer. Department of Radiology, University of Florida, Jacksonville, November 18, 1988
20. Henry DA: The Post-Cardiac Surgery Chest Radiograph. Annual Postgraduate Course in Thoracic Imaging, Society of Thoracic Radiology, Toronto, May, 1991
21. Henry DA: Clinical Integration of the Post-Cardiac Surgery Chest Radiograph. Annual Guest Lecture, Department of Radiology, St. Mary's Hospital, Richmond, Virginia, July, 1991.
22. Henry DA: Asbestos Film Interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconioses. Arlington, Virginia, September, 1991

23. Henry DA: Clinical Integration of the Post-Cardiac Surgery Chest Radiograph. Radiology Grand Rounds, Department of Radiology, Jefferson Medical College, Philadelphia, Pennsylvania, October 1, 1991
24. Henry DA: Asbestos Film Interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconioses. Arlington, Virginia, November, 1992
25. Henry DA: Asbestos Film Interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconioses. New Orleans, Louisiana, October, 1993
26. Henry DA: Imaging of Critically Ill Patients: Radiology of the Patient after Cardiac Surgery. Refresher course, Radiological Society of North America, Chicago, Illinois, December, 1993
27. Henry DA: Imaging of Critically Ill Patients: Clinically Focused. Refresher Course, Radiological Society of North America, Chicago, Illinois, November, 1994
28. Henry DA: Asbestos Film Interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconioses, Arlington, Virginia, March, 1995
29. Henry DA: CQI and the Process of Portable Chest Radiography, Society of Thoracic Radiology, Amelia Island, Florida, March, 1995
30. Henry DA: Imaging of Critically Ill Patients: Clinically Focused. Refresher Course, Radiological Society of North America, Chicago, Illinois, November, 1995
31. Henry DA: Practical Cardiac MR Imaging, MRI Continuing Education Seminar, St. Mary's Hospital, Richmond, VA, August, 1996
32. Henry DA: Asbestos film interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconiosis, Tyson's Corner, Virginia, October, 1996
33. Henry DA: PACS for the Enterprise, Focus on Teleradiology, ACR Virginia Chapter Meeting, Williamsburg, Virginia, May, 1997
34. Henry DA: Advances in Cardiac MRI, annual meeting of the Virginia Society of Radiologic Technologists, Charlottesville, Virginia, May, 1997
35. Henry DA: Pulmonary Radiology in the Critical Care Patient Unit by Unit: The Neurosurgery ICU. Annual meeting of the Society of Thoracic Radiology, San Juan, Puerto Rico, March, 1998
36. Henry DA: Asbestos film interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconiosis, Tyson's Corner, Virginia, October, 1998
37. Henry DA: CT for Pulmonary Embolism Valid or Vapor. Virginia Thoracic Society Meeting, Richmond, Virginia, October, 2000

38. Henry DA: Asbestos film interpretation. American College of Radiology Symposium on the Radiology of the Pneumoconiosis, Tyson's Corner, Virginia, October, 2001

39. Henry DA: Current Applications and Innovations in Chest CT. Interventional Bronchoscopy Seminar, Pulmonary Medicine Critical Care Division, Department of Internal Medicine, Virginia Commonwealth University Health System, Richmond, Virginia, October 2002

40. Henry DA, Brath LK, Parker MS: Chest Radiographic Signs: Case-Based Discussion for the Chest Physician. Chest 2002/American College of Chest Physicians, San Diego, California, November, 2002

#### **VISITING PROFESSOR**

1. Department of Radiology, University of Florida at Jacksonville, November 17-18, 1988
2. Department of Radiology, Jefferson Medical College, Philadelphia, Pennsylvania, October 1, 1991

#### **VIDEOTAPED LECTURES**

1. Henry DA: Radiologic Critical Care: Clinically Focused, Radiological Society of North America, Chicago, Illinois, RSP 483, 1995

Revised 10/28/05

## **Exhibit B**

**Prior Testimony**

I have read films for Newport News Shipbuilding

I have read films for law firms in Richmond, Norfolk, Washington, D.C., North Carolina, and Baltimore. I have never testified based on any of these reads, although I have been deposed a few times.

I have read films for Alcoa.

I have testified for the U.S. Government, defending it against asbestos claims

I have also read films for claimants on behalf of the VCU Occupational Pulmonary Committee

## **Exhibit C**

**RELIANCE MATERIALS**

See References at end of Report.